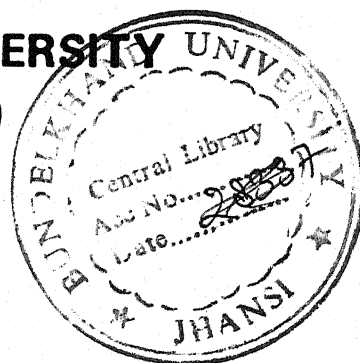


**INCIDENCE OF PEPTIC ULCER IN
EPIGASTRIC PAIN CASES : AN
IMAGE INTENSIFIER STUDY**

THESIS
For
DOCTOR OF MEDICINE
(RADIO - DIAGNOSIS)



BUNDELKHAND UNIVERSITY
JHANSI (U. P.)



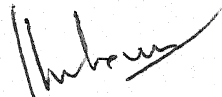
C E R T I F I C A T E

This is to certify that the work entitled
"Incidence of Peptic Ulcer in Epigastric Pain Cases :
An Image Intensifier study", which is being submitted as
a thesis for M.D. (RADIO-DIAGNOSIS) was carried out by
Dr. VIPUL KUMAR under my constant supervision and
guidance.

The technique employed in this work was under-
taken by the candidate himself. The results and observat-
ions were checked and verified by me periodically.

He has put in the necessary stay in the department
as required by the regulations of the Bundelkhand
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Dated: Sept., 30, 1993.


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(GUIDE)

C E R T I F I C A T E

This is to certify that the work entitled
"Incidence of Peptic Ulcer in Epigastric Pain Cases :
An Image Intensifier Study", was carried out by Dr.
VIPUL KUMAR under my constant supervision and
guidance.

The results and observations have been checked
and verified by me from time to time.

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C E R T I F I C A T E

This is to certify that Dr. VIPUL KUMAR has worked on the thesis entitled "Incidence of Peptic Ulcer in Epigastric Pain Cases : An Image Intensifier study", under my supervision and guidance.

The results and observations have been checked and verified by me periodically.

Dated : Sept., 30, 1993



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Dated : Sept., 30, 1993.

Vipul Kumar
(VIPUL KUMAR)

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INTRODUCTION

INTRODUCTION

Pain is the symptom for which most of the patients seek medical advice. Pain is a protective mechanism for the body; it occurs wherever, any tissue is being damaged, and it causes the individual to react and to remove the pain stimulus. It is generally accepted that free nerve endings are the primary receptors for the perception of pain. Pain receptors are either neuro-receptors stimulated by tissue injury or chemoreceptors stimulated by chemical substances like histamine, 5 hydroxy tryptamine, kinins etc.

The viscera have sensory receptors for no other modalities of sensation besides pain. Visceral pain is transmitted through sensory nerve fibres that run in the sympathetic nerves. These fibres are small type C fibres and, therefore, can transmit only burning and aching type of pain.

Epigastrium is the upper median quadrant of the abdomen bounded by the right and left lateral lines vertically and transpyloric line inferiorly and horizontally. Epigastric pain may be caused by a variety of causes. Peptic ulcer is one of the common causes of epigastric pain.

Other causes include oesophagitis, oesophageal ulcer, hiatus hernia with oesophageal reflux, gastritis, duodenitis, tumours of stomach, duodenum or pancreas, biliary tract disease, pancreatitis etc.

Epigastric pain may also occur in adult hypertrophic pyloric stenosis, hypertrophic gastritis (Menetrier's disease), duodenal diverticulitis, congenital webs, annular pancreas and Crohn's disease involving the stomach and/or duodenum.

Out of various causes peptic ulcer is the most common cause of epigastric pain. In the majority of uncomplicated cases of peptic ulcer the pain is sharply circumscribed to an area of about 2 to 10 cm. in diameter in the region between the xiphoid cartilage and the umbilicus. In very few other diseases patient is able to indicate the site of pain with the finger rather than with the entire hand.

Gastric ulcers often give rise to pain in the upper half of the epigastrium with a tendency to wards localization to the left of the midline.

In cases of duodenal ulcers localization of pain is most often in the midline between the xiphoid cartilage and the umbilicus. Occasionally pain is felt in the lower right abdominal quadrant or near the midline of the back between the 6th and 10th thoracic vertebra. Epigastric pain may be felt in acute pancreatitis and acute cholecystitis also, while referred pain may be felt in epigastrium in cases of myocardial infarction and acute appendicitis (Horracks, De Dombal 1978).

Pain of acute pancreatitis may be distinguished from peptic ulcer disease by it's abrupt onset and hyperenzymemia. Biliary tract disease is characterised by isolated episodes of the pain, without day-after-day distress and by the radiation of the pain to the right scapular region.

Upper abdominal pain simulating peptic ulcer may occur when the upper gastrointestinal tract is invaded by parasites (Wolfe 1978).

The significance of radiological examination of upper gastrointestinal tract is widely accepted. Conventional barium meal examination is a routine procedure to detect lesions of upper gastrointestinal tract.

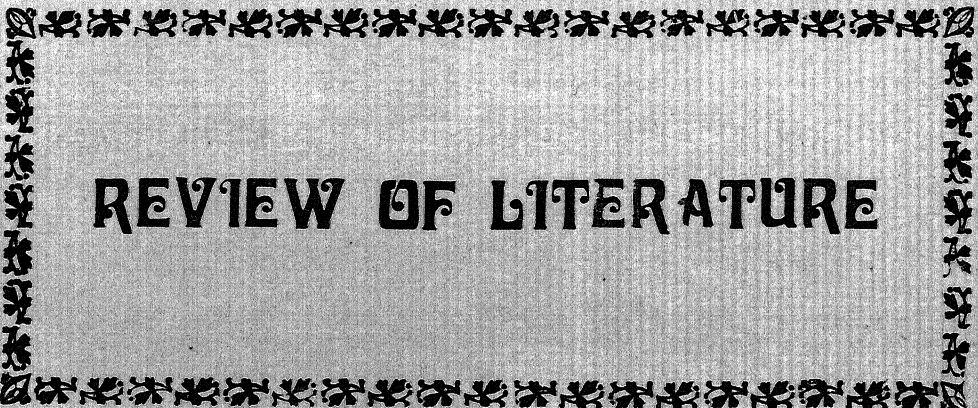
In the early days of gastrointestinal radiology, the accuracy of conventional barium meal was virtually unchallenged. The advent of endoscopy led investigative radiologists to develop the technique of double contrast barium meal.

It has been seen that the combined use of single and double contrast techniques yields the greatest potential diagnostic accuracy (Gelfand, Off 1981).

AIMS OF STUDY :

1. To study the incidence of peptic ulcer in the patients presenting with the complaint of epigastric pain.
2. To study the site, size and distribution of peptic ulcer in relation to age and sex.

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REVIEW OF LITERATURE

REVIEW OF LITERATURE : (Clinical Aspect)

The symptoms of peptic ulcer have been known for well over a century but apart from clinical description by Abercrombie (1828), Cruveilhier (1829), Brinton (1857) and Fox (1872), little was published about different pain patterns in gastric and duodenal ulceration until the turn of century (Fenwick and Fenwick 1900; Moynihan 1905 & 1910; Soupault 1906; and Bolton 1913).

Many have attributed particular symptoms to gastric and duodenal ulcer while others have denied such symptomatic specificity (Rivers 1934; Gainsborough and Slater 1946; Vogel 1948; Pasching 1950; Kirsner Kassriel and Palmer 1956; Littman and Bernstein 1962) and in many studies of peptic ulcer, the two entities have not been differentiated (Lynch 1927; Emerie and Monroe 1935; Held and Gold bloom 1946; Bockus 1951; Illing worth 1953; Jones 1957; Shay and Sun 1963).

It has been estimated that 10% of the population of western countries suffer from ulceration of the duodenum or stomach at some time during life (Langman 1979).

During the 19th century, gastric and duodenal ulcers were rare, and the relative proportion of the two types was

quite different from that a few decades later, with similar striking difference in the types of patients suffering from ulcers.

Ulcers during the 19th century were usually gastric ulcers that occurred in young women, often under 20 years of age and mainly ^{under} 30, of low social class (Munt 1980, Jenner 1940).

Duodenal ulcers were very uncommon until the second quarter of the 20th century. The incidence of duodenal ulcer, thereafter, became much greater than the incidence of gastric ulcer in most parts of the world.

As gastric ulcer became less common, it tended to afflict the elderly of both sexes and men more than women. (Brown 1976).

Incidence of peptic ulcers shows a marked variation with geographical changes, different dietary habits and among different socio-economic groups. Incidence of peptic ulcer is also different for different age groups and between two sexes.

Peptic ulcers are very rare among Eskimos in Northern Greenland and among South-Western American Indians (Sievers 1962). By contrast in North-Western coastal American Indians, the prevalence is quite high (Shore 1973).

In Africa, high prevalence areas occur along the west coast, in the Nile-Congo watershed, in northern Tanzania, and in Ethiopia (Tovey 1975). There apparently is an increased frequency of ulcers in large cities, while rural prevalence is low.

In India, there are also marked regional differences. High prevalence areas are found in the south, up the west coast to Bombay, all the way up the east coast, and in the plains of Assam and Kashmir. A low frequency is found in the north of India, the Punjab and adjacent areas (Tovey 1979). There are some striking local regional variations as well, as in the Orissa, where a high frequency of ulcer problems is encountered in the plains among rice eaters, while ulcers are rare among the residents of adjacent hills, who eat foods such as pulses and millet (Tovey 1979).

The reasons for the geographic differences have been considered to depend on climatic dietary, and ethnic differences in the different areas and between different population.

In India, the variations have been attributed to climatic as well as dietary differences, with peptic ulcer more common in wet and humid areas than in dry and arid ones (Malhotra 1964).

Bonnevie O (1975) in his study from Copenhagen country, between 1963 and 1968, found that annual incidence of new duodenal ulcers was 1.3/1000, with a male to female ratio of 2.2 : 1. The annual incidence of new gastric ulcers was 0.31/1000, with a male : female ratio of 1.1 : 1.

In a vast country like India, it is impossible to obtain exact figures of disease incidence. Because of the difficulty in obtaining exact information, areas are described as having a high incidence when duodenal ulcer constitutes a major clinical problem and a low incidence area where it is not regarded as a significant problem (Tovey 1979).

Population surveys performed in Delhi and Chandigarh showed incidence of duodenal ulcer 0.60% and 0.69% respectively. These regions are considered as areas of low incidence (Chuttani 1967, 1968).

Survey performed at Bombay by Raghavon 1966 showed incidence of duodenal ulcer as 2.8%. Surveys conducted at Vellore, showed incidence of 1% and 1.18% (Gault 1959, Benjamin 1964).

Duodenal to Gastric Ulcer ratio :

The average ratio of duodenal : gastric ulcer in India calculated from higher incidence areas is 12.4 : 1. Corresponding personal survey by Tovey showed different ratio i.e. 32 : 1 (in United Kingdom, the corresponding ratio was approx. 3.4 : 1 in 1950 and has fallen to 2.3:1) (Tovey 1979).

Age of Occurrence:

In western Europe, there has been a progressive increase in the peak age of occurrence of ulcers. In the United states and the United Kingdom, the mean age at which peptic ulcers were diagnosed has tended to increase (Elashoff 1980, Coggon 1981). In less developed countries the peak prevalence and incidence rates occur in younger age groups (Malhotra 1964, 1967; Tovey 1975).

In India, the peak age of occurrence of duodenal/gastric ulcers is 30-40 years, about 10 years younger, than in west (Tovey 1979).

Sex distribution :

There has been a striking change in the sex distribution of peptic ulcer during the past century (Langman 1973).

In the early 19th century, there was a marked female preponderance of 5 : 1. The ratio became equal in about 1915, after which male preponderance started (Jenner 1940). More recently preponderance of men has decreased in western countries, while the incidence of duodenal ulcer in women has increased.

In his study Tovey (1979) found the sex ratio of peptic ulcer, in India, as 16.6 : 1 (range 7.2 to 32). In United Kingdom this ratio was 1.9 : 1 in recent years.

Epigastric pain may be caused by a variety of causes. Peptic ulcer is one of the common cause of pain in epigastrium. Other causes may include oesophagitis, oesophageal ulcer, hiatus hernia with gastro-oesophageal reflux, gastritis, duodenitis and tumours of stomach, duodenum or pancreas. These causes may be differentiated radiologically.

In biliary tract disease pain is usually localized to right upper quadrant and radiate to right scapular region. Conversely pain may persist in the epigastrium without radiation in 25% of patients with biliary tract disease (Morrocks De Dombal 1978).

Acute pancreatitis may cause epigastric pain which may be distinguished from uncomplicated peptic ulcer disease by its abrupt onset and elevated serum amylase level.

Upper abdominal discomfort may occur when the upper gastrointestinal tract is infested by parasites (*Giardia Lambia*, *Strongyloids stercoralis* and hookworms) (Wolfe 1978).

Compression of the Coeliac axis by the arcuate ligament of the diaphragm has been shown as a cause of epigastric pain.

Intestinal ischemia due to mesenteric artery embolism may similarly give rise to postprandial periumbilical or infraumbilical pain.

The so called irritable colon syndrome may include upper abdominal pain.

Epigastric pain, occurring independently or accompanied by vomiting, may be seen in adult hypertrophic pyloric stenosis and perhaps pyloric mucosal prolapse and erosive or hypertrophic gastritis (Menetrier's disease).

Epigastric pain may be the presenting feature of duodenal diverticulosis, duodenal neoplasm, congenital webs, and annular pancreas.

Crohn's disease may involve stomach and/or duodenum and present with epigastric pain. Both peptic ulcer and crohn's disease may coexist (Langman 1976).

Epigastric pain may be of musculoskeletal origin. Radiculopathy giving rise to epigastric pain may be due to entrapment of peripheral nerves at the site of surgical scars or by the border of rectus sheath. This pain has a segmental distribution along the course of nerve and superficial tenderness. Neuromuscular pain may coexist with peptic ulcer or other visceral pathology.

Diabetic radiculopathy involving the thoracic nerve roots may also give rise to chronic abdominal pain (Longstreth, Newcomer 1977).

Epigastric pain, burning or distress, with or without nausea and vomiting, may result from the ingestion of many drugs including non steroidal anti inflammatory agents, broad spectrum antibiotics, theophylline, digitalis, potassium chloride, corticosteroids and many other drugs.

Functional dyspepsia is one of the commonly encountered cause of epigastric pain and fullness. These patients lack many of the classic characteristics of peptic ulcer disease. They also commonly have other symptoms such as fullness, bloating, belching, flatulence, nausea and sometimes vomiting.

Edwards FC and Coghill NF (1968) in their series of 464 patients found that 70% of the patients of peptic ulcer presented with pain in epigastrium. Onset of pain was within 30 minutes of a meal in 20% of patients with gastric ulcer and 5% of duodenal ulcer, and over 3 hours after a meal in 30% of patients with duodenal ulcer and 20% of gastric ulcer patients.

Mollman KM, Bonnevie O, Gudmand HE and Wolfe HR (1975) studied 197 patients with upper abdominal pain and found that 25% of them had duodenal ulcer, 13% had gastric ulcer, 6% were diagnosed as gastric cancer while 55% had X-ray negative dyspepsia. They postulated that relationship of pain with meals is of considerable predictive value. If the pain was relieved by meals there was 30% probability of having duodenal ulcer. The probability of gastric ulcer was less affected by the character of the pain, whereas the probability of X-ray negative dyspepsia was considerably higher in patients whose pain was worsened by eating. They also showed the diagnostic value of age. A low age (less than 40 years) increased the probability of X-ray negative dyspepsia, whereas a higher age (more than 60 years) increased the probability of gastric ulcer.

Horrocks J and De Dombal (1978) studied the clinical presentation of patients with dyspepsia in a series of 360 patients. They found that out of 280 patients presenting with epigastric pain, 53.7% had peptic ulcer. 74% of peptic ulcer patients had pain solely in epigastrium while rest of the patients had pain in right or left hypochondrium as well.

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REVIEW OF LITERATURE : (RADIOLOGICAL ASPECT)

It was not long after the discovery of the X-rays that efforts were made to examine the gastrointestinal tract roentgenographically. As early as 1896, Becker tried to fill the stomach and bowel in guinea pigs with metal salt (a lead solution) and was thus able to demonstrate various segments of the gastrointestinal tract. He pointed out the possibility of visualisation of the human gastrointestinal tract.

Moser and Cannon (1896) demonstrated the phenomenon of swallowing in a goose by giving it a capsule of Bismuth subnitrate mixed with bread. Cannon (1897) used a mixture of bread and bismuth for studying peristalsis in cat's stomach.

Rumpel (1897), Roux et al (1897) used Bismuth for the study of motor functions of oesophagus and stomach respectively. Cannon (1897) selected Bismuth and Barium as the two most likely contrast media for the study of gastrointestinal tract. However, he reported the use of Barium as early as 1904, long before the general presentation by Bechem and Cunter (1910).

Rieder (1904) formulated Bismuth meal and gave the idea of using standard projections, time of observations and criteria of diagnosis.

In 1908, Auguste Crane et al presented the entire subject of X-ray examination of stomach including the study of its motion, physiology and changes that occurred with gastric ulcer.

Goasta Foressel (1905) devised the Forssell fluoroscope for positioning the patient in order to obtain what he called focus roentgenograms and what now is called as 'spot films', Forssell (1910) introduced the technique of white washing of gastric mucosa by taking a mouthful of Barium, for evaluation of gastric mucosa.

Lewis Gregory Colehed abandoned the fluoroscope at an early date and by 1910, was taking 10-12 plates of stomach and duodenum in different projections. He also demonstrated compression roentgenography and correlated it with surgical findings in ulcers and cancers of the stomach and duodenum. Cole was one of the first radiologist to attempt delineation of mucosal pattern of stomach. More knowledge for gastric mucosal evaluation was extended by numerous workers including Elischener (1911);

Redich (1923); Bansch (1926) and Berg (1926 and 1930). In spite of the experience gained with technique of evaluation of gastric mucosa suggested by Rendich (1923) and elaborated by Berg (1954), the degree of accuracy to evaluate lesions in the stomach was far from ideal. This stimulated further modification in technique and led to the development of double contrast technique.

The concept of air insufflation of stomach and that of double contrast study is not new. Since early days of Roentgenology, many methods of producing double contrast studies of stomach and duodenum have been described. These procedures have included the use of effervescent powder (Feissly, 1930; Lyholms Poppel and Roach 1945) and carbonated beverages, insufflation and inflation of the stomach by means of inserting tube (Wasch and Epstein 1944) and balloon (Pirkey 1949) and utilization of air physiologically present in the stomach (Amplatz 1958).

The potential value of the double contrast technique as an alternative to palpation method was recognised by Hampton in 1937. Using swallowed air and a barium suspension of creamy consistency, he demonstrated duodenal ulcers and prepyloric carcinoma.

In 1952, Ruzicka and Rigler described a method for double contrast examination of stomach. Their examination required nasogastric intubation. The quality of mucosal coating was not excellent because of bad Barium suspensions available at that time (High viscosity and low density). It was used only in certain cases where definite diagnosis remained doubtful after routine procedure. However, the accuracy of the procedure in differentiation of polyps from prominent rugal folds was reasonably good. These authors felt that the intragastric balloon method (Pirkey 1945) for double contrast was inferior to insufflation of stomach through nasogastric tube because a good deal of unpleasantness of introducing balloon into stomach by Pirkey's method was, thus, avoided.

In 1950, a group of gastroenterologists in Japan, under the leadership of Prof. Hikoo Shirakabe were studying the pathological morphology of intestinal tuberculosis, utilizing double contrast examination of colon. This study led them to develop a double contrast technique for the examination of stomach. Their initial interest was in the demonstration of gastric ulcers particularly linear ulcers that had not been demonstrated on conventional studies. This experience led them to further refinement in the technique for the radiological

diagnosis of early gastric cancer as small as less than 10 mm across and less than 1 mm thick. This type of examination became a routine in Japan during the 1960's and spectacular results have been achieved both in mass screening programme and in the evaluation of symptomatic patients. In the patients who were diagnosed having carcinoma stomach by double contrast Barium meal and subsequently operated, about 90% showed survival rate of 5 years.

Amplatz (1958) described a new and simple double contrast technique for study of stomach and duodenum. In his technique the patient was asked to drink Barium suspension through an artificially perforated straw, to get air and Barium inside the stomach. He claimed that this technique was simple without any practical limitations seen in earlier methods i.e. inflation of stomach by balloon or nasogastric tube. There is no distortion of mucosal coating or over distension which is very common with carbonated drinks or effervescent powders. He published a few cases and found that this technique gave satisfactory double contrast studies of upper gastrointestinal tract.

Foti M (1963) in an attempt to improve the mucosal relief technique, developed double contrast method with mucosal spraying. A suitable appliance (the probe) was introduced into the stomach with the patient supine and insufflation of air carried, followed by spraying of Barium on the gastric mucosa under examination. He did 40 cases without any complication and demonstrated its advantages over conventional Barium meal by way of illustration. However, this technique was not widely accepted because of lack of simplicity in the technique.

Buonocore (1967) described a triple contrast technique for the evaluation of upper gastrointestinal tract in certain selected cases. He used spray method described by Foti (1963) to produce double contrast visualization of the stomach. This was reinforced by the addition of pneumoperitoneum to get a triple contrast view of the stomach wall. This procedure allows the thickness of the wall of stomach to be measured accurately but it was not accepted widely due to technical difficulty.

Toriola F Solanke et al (1969) described a procedure which could be a part of routine radiological examination of the stomach. Examination done empty stomach under fluoroscopic control. The patient drinks a mouthful of Barium sulphate suspension and a mucosal study is carried out in both the supine and prone positions. While in the upright position, the patient takes 200 to 300 ml of Barium sulphate suspension and a Barium filled film is taken in horizontal position, the stomach is insufflated with 200 to 200 ml of air through a nasogastric tube. After the insufflation, the patient is immediately and quickly rolled from side to side to ensure that the mucosa is well coated with Barium. The examination is then conducted in the following sequence - 1) supine, 2) right oblique, 3) left oblique and, 4) upright positions.

Keliichi Kawai et al (1970) emphasised the importance of detection of early gastric lesion. Among the various techniques employed for the radiographic examination of the stomach, he found that double contrast method is highly satisfactory.

Formation and retention of gas bubbles was a major problem in the technique of double contrast examination employed by Obata (1972). He suggested the use of an antifoaming agent e.g. Simethicone to remove this unwanted effect.

Kreel (1973) devised his own modification of the double contrast technique. He used 50 ml of Barium (100% W/V) for anterior wall, in prone position with a pillow under patient's abdomen. After the evaluation of anterior wall was complete, he gave more Barium (upto 200 ml) in the same position, alongwith gas producing agent. Films were taken in supine, left posterior oblique, semi-erect, right posterior oblique, erect left posterior oblique and in the end, compression spot films in erect and semi-erect position for body of stomach. He compared his barium results with those of endoscopy and reported 80% correlation between the two techniques.

Scott Harden (1973) argued that the Japanese method of doing double contrast examination of stomach was quite cumbersome and time consuming. In his modification, he gave 40 cc of diluted Barium suspension in erect position followed by an effervescent drink

and finally 40 cc of Barium in horizontal position. The patient was asked to rotate a full circle. Films were taken under fluoroscopic guidance in different projections. He found the results of his study (conducted over a period of 6 years) quite comparable to endoscopic findings.

A simple procedure for performing double contrast examination of stomach was described by O Reilly (1974). Two different stock preparations of Barium sulphate suspensions were prepared, containing an antifoaming agent. To one preparation sodium bicarbonate was added and to the other citric acid. The patient was asked to take 75 ml of each suspension to make a total of 150 ml. As a result of rotation of the patient, the two solutions reacted with each other to produce carbon dioxide gas within the stomach. Films were taken in different projections. The author concluded that the procedure was simple and could be routinely performed.

M. Sasagawa and H. Ichikawa (1974) described a technique for complete evaluation of gastric mucosa which is a combination of conventional method and double contrast method. They used 250-300 ml of Barium having 15-20 CPS viscosity at concentration of 100% W/V with

suitable amount of air (ingested through nasogastric tube). They stated that the conventional method has following advantages :

- 1). Diagnosis for a comparatively wide range of field is possible.
- 2). Changes in the outline of the stomach are clearly visualized.
- 3). Distensibility of gastric wall is clearly revealed.
- 4). Deformation of the stomach is clearly demonstrated.
- 5). The results are not greatly influenced by gastric juice or food residue.
- 6). The technique is simple.

But at the same time, the conventional technique suffers from following disadvantages :

- 1). Blind spots occur in the part of the anterior and posterior walls far from the margin of stomach, being hidden behind Barium.
- 2). Capacity for demonstration of fine changes is not sufficient.

So they combined the conventional method with double contrast technique using the same Barium but distended the stomach with air 200-300 ml (introduced through nasogastric tube). Their film sequence for routine examination was as follows :

- a) Mucosal method in prone position (1-2 films).
- b) Conventional method in Sagittal standing position (1 film).
- c) Conventional method in left posterior oblique (LPO) standing position (1 film).
- d) Conventional method in prone method (1 film).
- e) Double contrast (DC) method in right anterior oblique prone position (1-2 films).
- f) Double contrast method in right posterior oblique supine position and semi supine left posterior oblique position (1 each of spot films).
- g) Conventional method in left posterior oblique erect position (1 film).
- h) Compression method in standing position (spot films).

The authors found that the double contrast method has following advantages :

- 1) Fine irregularities of mucosal surface of stomach are accurately demonstrated (0.2 - 0.3 mm gastric fissures between areae gastricae are clearly seen).
- 2) Findings for gastric margins and distensibility of gastric wall are demonstrated well.
- 3) Diagnosis of lesions in the upper stomach is possible.
- 4) Diagnosis of anterior wall lesions is possible.
- 5) Reproducibility of the picture is high.

They also pointed out the demerits of the double contrast method, which are :

- 1) There is overlapping of duodenal and jejunal loops leading to the loss of details.
- 2) The part of gastrointestinal tract overlying the spine cannot be evaluated properly.
- 3) There has to be a sufficient amount of gas in the stomach all the time.
- 4) Evaluation of anterior wall of stomach is technically difficult.

Sasagawa and Ichikawa (1974) further described certain special procedures to evaluate the anterior wall of stomach thoroughly. These are :

A) THIN LAYER METHOD :

- Dilute Barium (10 to 60 percent W/V) should be used.
- 100 - 300 ml of air should be used alongwith 30 - 100 ml of Barium.
- Films are taken in semi erect position in prone posture routinely.

The whole study has to be performed quickly and efficiently as it is difficult for the patient to lie in prone position with nasogastric tube for a long time. Though this method is technically most difficult to perform, but yields the best results diagnostically, particularly for the depressed lesions in anterior stomach wall.

B) PRONE POSITION MUCOSAL STUDY :

This method involves the ingestion of very small amount of Barium (20-30 ml). Films are taken in prone position. The study is considered to be of good quality as it shows individual folds separately and the Barium is seen only in the intervening parts between the folds. Various limitations and disadvantages of this procedure are :

- As only small amount of Barium is used, the final picture is greatly influenced by gastric residue present.
- Lesions smaller than the width of the mucosal fold cannot be seen.
- If there is delay in the completion of the procedure, overlapping of Barium in the stomach and duodenum leads to obscure the details and difficulty in interpretation.
- Lesions discovered by this method can be seen better by double contrast method.

C) ANTERIOR WALL DOUBLE CONTRAST METHOD :

This procedure is also known as prone position double contrast method. It was initially described by Kumakara and later supported by Sasagawa and Ichikawa. The technique consists of following stages :

- Good bowel cleansing is an essential pre-requisite of the procedure.
- There should be no gastric residue before the commencement of the procedure.
- Anti spasmodics are used to cause relaxation of mucosal folds.
- Small amount of Barium is given (30-100 ml).

- A large volume of air (about 300 ml) is introduced through nasogastric tube.
- Films are taken in prone position with different degrees of tilt so that all the parts of the stomach can be seen in double contrast separately.

D) COMPRESSION METHOD :

It consists of application of suitable compression over stomach under fluoroscopy and films are taken in suitable positions. This procedure gives a consistent and clear visualization of fine mucosal lesion located on anterior and posterior walls of stomach. A significant drawback of this method is the inability to define lesions in the upper part of stomach which lies under the ribs and hence cannot be compressed adequately.

The Japanese workers in this field attracted little attention elsewhere in the world for many years due to relatively less serious problems of gastric malignancy outside Japan. The late 1960's and early 1970's saw the publication of several modifications of the Japanese techniques.

Louis Kree1 (1974) used the double contrast method in the study of surface pattern of the stomach. He found that the surface pattern of the stomach show a marked variation depending upon the Barium preparation used. A marked variation in the surface coating and radiographic appearance was found. A thick, smooth coating with trapped air bubbles occurred with one Barium. Although partial visualization of the areae gastricae was present.

Another Barium showed occasional areae gastricae and produced an uneven surface.

The third Barium showed quite good visualization of areae gastricae but also produced small Barium precipitate or floccules imitating erosions. Only the fourth Barium was consistently able to produce areae gastricae with no bubble trapping or tiny flocculateris. It was therefore, this Barium which was used for routine double contrast gastric examinations.

Laufer (1975) listed the requirements for a good double contrast barium meal as follows :

1. There should be no gastric residue.
2. There should be adequate gaseous distension of stomach.

3. An antifoaming agent (e.g. simethicone) should be used to prevent the formation of gas bubbles.
4. A low viscosity and high density preparation of barium sulphate should be employed.
5. The films should be taken as quickly as possible after patient's rotation because the quality of mucosal coating deteriorates within seconds.
6. Good quality spot films should be taken with the help of small focal spot (0.6 mm) and bucky.
7. The study should be completed before the overlapping of barium in stomach and small bowel starts.

Taking all the above requirements into consideration, Laufer was able to demonstrate gastric erosions in 10 patients out of about 1800 patients who underwent double contrast study. Seven of these 10 patients had positive endoscopic correlation also. He observed that superficial lesions e.g. erosions and linear scars are demonstrated on double contrast study well only if the visualization of *areae gastricae* is taken as an index of good mucosal coating. He reported an overall

correlation of 94% between endoscopy and double contrast study. Moule (1975) also compared the two procedures and found somewhat lower correlation (84%) between the two.

Laufer further described the essentials of the double contrast interpretation as follows :

a) ELEMENTS OF DOUBLE CONTRAST IMAGE :

Generally speaking there are three elements contributing to each double contrast image. These include the dependent surface, the non-dependent surface and the barium pool. The position of the patient determines whether a surface is dependent or non-dependent.

The dependent surface is lined by a thin layer of barium, with some occasional small puddles of barium if the dependent surface has undulations.

The non-dependent surface has thinner coating of barium and there is no barium pool or puddle since any free barium tends to fall off.

The barium pool is a bolus of the barium that is not adherent to the mucosal surface. It is found in the most dependent segment and small puddles are found where there are minor depressions. Barium pool

is used to wash and coat the mucosal surface and to fill any depressed lesion e.g. ulcer crater, grooves in between the mucosal folds. It also helps to demonstrate protruding lesions on the dependent surface. Its chief drawback is that it can obscure lesions on both the dependent and non-dependent surfaces.

b) NON-DEPENDENT VERSUS DEPENDENT WALL STRUCTURE :

Because of the difference in barium coating the dependent and non-dependent surfaces have somewhat different appearances e.g. in supine position, posterior wall is dependent and anterior wall is non-dependent. A rugal fold on posterior (dependent) wall appears as a radiolucent defect in the barium puddle while a rugal fold on the anterior (non-dependent) wall appears as two thin white lines (rail-track sign) as the X-ray beam is attenuated by the barium coating on either side of the mucosal folds, thus the anterior (non-dependent) wall fold is etched in white. Similar reasoning applies to the protruding lesions i.e. on dependent surfaces, they appear as radiolucent filling defect, whereas in the non-dependent surface, the margin of the lesion is etched in white.

Depressed lesions e.g. ulcer crater on the dependent surface gets filled with barium and is easily recognised; if there are radiating folds, they will be radiolucent. However, if the depressed lesion is shallow, the barium may appear as a ring shadow only due to coating of base and sides of the depressed lesion. An ulcer crater (depressed lesion) on non-dependent surface will also produce a ring shadow as there is no barium pool or puddle to fill the crater since any free barium would fall from the non-dependent surface.

Igor Laufer (1975) also summarised the advantage of DCBM over standard barium meal study as follows :

1. Increased sensitivity for detection of superficial lesions.
2. Fewer false positive radiological diagnosis.
3. Allows for thorough examination of fundus.

His technique of double contrast has the following advantages over other described methods :

1. Nasogastric intubation was not used.
2. Hypotonic drugs are rarely necessary and therefore examination of duodenum is not impaired.

3. Minimal amount of patient rotation is necessary.
4. Good mucosal coating is achieved regularly.

He also described the difficulties encountered in the performance and interpretation of these double contrast studies which include :

1. In presence of excess fluid in the stomach, the quality of mucosal coating is not good. If the coating is inadequate even larger lesion can be missed.
2. Characteristic artifacts can be produced by gas bubbles, flocculation of barium and inadequate distension of the stomach.

Igor Laufer (1976) presents a detailed analysis based on experience in 1500 patients examined by double contrast barium meal and compared the results with those obtained with the conventional barium meal study.

The value of technique was assessed by -

1. The demonstration of lesion not generally demonstrable by the standard technique (conventional barium meal study) and;

2. Comparison of the radiological and endoscopic findings in 225 patients examined by fibroptic oesophagogastroduodenoscopy after the radiological study.

Lesions not demonstrable by the standard method are -

- (i) Superficial gastric erosions,
- (ii) Linear ulcer,
- (iii) Ulcer scar,
- (iv) Areae gastricae

Radiological error was found in only 7% of the patients in the examination of 225 patients by endoscopy.

James (1976) used different techniques for the production of gas in 280 examinations of double contrast barium meal and compared them. He concluded that nasogastric intubation was the best but caused discomfort to the patient. Gas producing tablets are better than effervescent powders/drinks because tablets cause slow, release of gas resulting in minimum bubble formation.

Martin (1976) doubted the utility of routine anterior wall examination as a part of double contrast study as practiced by the Japanese. He could find only

four ulcers on anterior wall out of 105 gastric ulcers in 1500 cases. Hence, he suggested that due to its low diagnostic yield, anterior wall examination should not be routinely performed.

J.H. Hunt and I.F. Anderson (1976) described a technique for routine hypotonic double contrast studies of the upper gastrointestinal tract. Principles of the technique are to obtain good mucosal coating and gas distension and to understand the principles of anti-spasmodics.

Factors Affecting Mucosal Coating :

1. Barium - should be of high density and low viscosity of atleast 70% W/V suspension.
2. Cleanliness of the stomach - Stomach should be free of fluid, use of metoclopramide appears to be helpful in achieving a cleaner stomach.
3. The volume of barium used - It is possible to perform a good examination with a volume of 40 to 50 cc but this requires a very clean stomach.
4. Application of barium to the gastric wall - Most important factor in achieving good coating is repeated washing of the mucosal surface with the barium bolus by rolling and posturing.

5. Radiographic factors - A KV range of 80 to 85 is preferable as this is in a spectrum of maximum absorption by barium.
6. Disease present - In mucus secreting tumours good coating can be achieved by repeated washing with additional barium. In pyloric stenosis gastric aspiration is necessary but good coating is obtained by repeated rolling.

B. Distension of the stomach with gas :

- i. Generation of gas - Earliest method to produce gas is to use a fine powdered effervescent mixture to which a minimum quantity of anhydrous glycerine is added.
- ii. Adequate distension - The degree of distension aimed for is one just short of complete obliteration of the mucosal folds.
- iii. Bubbles - a foam control agent is necessary.

A dimethylpolysiloxane emulsion with both anti-foaming and defoaming properties is preferable.

Use of Antispasmodics :

Buscopan (Hyoscine-N-Butylbromide) has proved to be the best drug for the routine use, 20-30 mg

being given intravenously. It's effect comes in 5-8 minutes, which coincides with the duration of examination.

Bagnall (1977) described an apparatus for the study of foam formation in double contrast preparation in vitro. Foam formation in double contrast barium meal examination, using effervescent powder, may lead to poor mucosal definition and mucosal coating. He studied the efficacy of number of conventional antifoaming agents against barium sulphate foam. Anti-foaming agents are shown to be of considerable benefit to the double contrast technique. Silicon and silicon free antifoamers being equally effective. Silicon antifoamers are preferred because of their wide clinical acceptability.

Mohammad (1977) asked the patient to drink barium suspension through a straw with a side hole of 0.7 mm diameter. Barium and air got sucked in the correct proportion and resulted in a good double contrast study.

Levelle (1977) observed that for the diagnosis of duodenal ulcer, both the conventional barium meal technique and double contrast method are almost equally effective but the deformed duodenal cap is more accurately seen on double contrast examination.

Cumberland (1977) compared barium preparation in vivo and in vitro and observed that ideal barium suspension for double contrast barium meal should have concentration above 60% w/v less than this gives bad coating. It should not be more than 200%, which gives bad coating in addition to air bubble retention.

Gelfand (1980) reported that double contrast barium meal gives more artefacts than conventional barium, if the mucosal coating is bad. Roberts (1977) observed the behaviour of various barium sulphate suspensions when provoked with gastric secretion. The stability of the suspension was found to be influenced by the pH, the mucin content and the volume of secretion. It was noticed that the flocculation of the suspension in the presence of gastric residue decreased as the amount of undiluted barium sulphate in the mixture was increased.

The role of the DCBM in patients with acute upper gastrointestinal bleeding was emphasised by Fraser (1978). He performed DCBM examination in 107 patients with upper gastrointestinal bleeding and was able to identify the presumed bleeding site in 75 cases (70%).

Cohen (1979) studied the efficacy of cimetidine in reducing the gastric secretion and thus improving

mucosal coating in the DCBM examination. He found that although the patients receiving cimetidine scored better for mucosal coating and visibility of areas gastricae than the control group, the differences were not statistically significant. Similarly, Gopichandran (1980) conducted a prospective controlled trial to evaluate the usefulness of Metoclopramide prior to the DCBM examination. The results indicated that this did not significantly alter the quality of examination.

Montgomery (1982) assessed the properties of 6 different commercial barium suspension with their recommended gas producing agents designed for upper gastrointestinal use. The qualities assessed were mucosal coating of stomach and duodenum, areas gastricae, gaseous distension and Bubble formation in a total of 258 patients. It was found that each preparation had its merits and demerits and none was ideal.

Thomson (1983) reviewed and followed 199 cases of benign gastric ulcers out of a total of 7600 double contrast barium meal studies performed between 1975 and 1981. None of these ulcers was found to be malignant by subsequent endoscopy and biopsy.

Young (1983) compared the usefulness of overhead films and spot films in double contrast barium examinations. He found that overhead views missed 26% of the lesions, diagnosed on spot films, but diagnosed no lesion not also seen on spot films. He thus favoured the use of only spot films for DCBM examinations.

Dooley (1984) compared the DCBM and endoscopy in a blind prospective fashion in one hundred randomly selected patients. Endoscopy was found to be more sensitive (92% versus 54%) and more specific (100% versus 91%) than the DCBM. Although errors with the barium study related predominantly to an inability to show subtle lesions, poor patients cooperation and perceptual and technical failures were additional significant factors. These observations of Dooley were challenged by Gelfand (1984). He pointed out that many of these comparative studies between DCBM and endoscopy were flawed by errors in methodology that largely invalidated their conclusions. These errors were :

1. The use of endoscopy as an infallible standard for the comparison.
2. Comparison of state - of the - art endoscopy to poorly controlled radiologic studies.

3. The unavailability of radiologic and clinical information to the endoscopist.
4. Most recent discussions of this subject have been written by Gastroenterologists expressing the endoscopic point of view.
5. When endoscopy is used as the 'standard' all endoscopic errors become radiologic errors, adding to the quoted radiological error rate.

However, when compared to a third diagnostic method such as surgery or autopsy, radiology and endoscopy are found to be similarly effective (approx. 85% sensitivity rate of both techniques). In comparison radiology has the advantage of safety (endoscopy has mortality of 1 in 10,000 cases) and cost (approximately 1/3 of endoscopy). Hence, these authors concluded that radiology should be advocated as the more desirable initial examination of gastrointestinal tract.

Young (1985) also showed similar views that the DCBM should be preferable to endoscopy as the primary method of investigation of the upper gastrointestinal tract. To make DCBM examination more efficient, quick and cost-effective technique, he suggested the necessity of minimum number of undercouch views.

Rubisin SE, Herling H (1986) showed the effect of barium suspension viscosity on the delineation of areas gastricae.

S. Artein, Girdwood TG et al (1987) studied 441 consecutive patients referred for endoscopy after a negative DCBM to determine the reliability of good quality radiology in excluding significant upper gastrointestinal pathology. They showed that a technically satisfactory and carefully reported negative DCBM performed by an experienced radiologist, in the cooperative patient will miss the upper gastrointestinal pathology very infrequently. The main cause of discrepancy between radiology and endoscopy is the failure to demonstrate or recognise duodenal ulcer. When gastric cancer is not demonstrated radiologically in the patients presenting with classical symptoms, this possibility should none the less be considered as likely when gastric mucosal atrophy is demonstrated in patients presenting with late onset dyspepsia, anorexia and loss of weight.

Mare S Levine, Stephen E Rubesin, Hans Herlinger, Igor Laufer (1988) described double contrast upper gastrointestinal examination technique and interpretation.

Technique : The routine double contrast upper gastrointestinal examination should ^{be} performed as a biphasic study in which both double contrast and single contrast views of stomach and duodenum are obtained. The basic elements in double contrast examination included - (i) mucosal coating; (ii) gaseous distension; (iii) hypotonia (inj. glucagon 1 mg is used to produce hypotonia) and; (iv) manoeuvres.

For performance of the double contrast examination a standard set of manoeuvres is required to achieve adequate mucosal coating.

The examination must be performed quickly since overlapping of loop of barium filled small bowels may impair visualization of the stomach and duodenum.

He described a standard routine for performance of examination and also described the various positions to visualise various parts of upper gastrointestinal tract.

Interpretation : First of all, they discussed the normal appearance of oesophagus, stomach and duodenum and then interpreted the depressed lesion and protruded lesion of oesophagus, stomach and duodenum in detail.

J Odo Opden Orth (1989) discussed the current value of barium technique in the evaluation of the upper gastrointestinal tract and compared with endoscopy.

He described the technique of single contrast studies, double contrast studies and biphasic study.

Single contrast study can be performed as -

- i) Mucosal relief ;
- ii) Complete filling or full column ;
- iii) Compression studies.

The method has limitation as entire oesophagus and upper part of the stomach cannot be compressed.

Double contrast study : Obtained by coating the inner surface of a distended hollow viscous with a thin layer of a positive contrast medium usually a barium suspension. Distension is obtained by gas. The fine mucosal relief of the stomach and duodenum can usually be appreciated.

Biphasic study : A biphasic technique that employs both modalities avoids the blind areas inherent to single and double contrast techniques when they are used alone.

In stomach and duodenum, double contrast studies reveals most of the lesions.

By his study he concluded that biphasic contrast studies are the best current examination for upper gastrointestinal tract. In two blind trials he compared the diagnostic results of a biphasic contrast examination, employing a medium density barium suspension and glucagon with endoscopy.

Both methods appear to have nearly equal merit for the detection of peptic ulcer and gastric carcinoma.

Biphasic examination preferably with drug induced hypotony, therefore, appears to represent an appropriate initial examination in evaluation of most disorders of the upper gastrointestinal tract. If this examination prompts the slightest suspicion of a malignant tumour endoscopy should follow for the biopsy purpose.

A biphasic approach with a medium density barium suspension can be attempted in nearly every patient if patient proves unable to cooperate for an optimal double contrast examination a single contrast examination can be performed with the same barium swallowed.

A single contrast study with high density barium is often inadequate because important lesion may remain undetected in a too dense pool of barium.

C Gray P et al (1989) reported two cases in which accidental inhalation of barium contrast medium occurred owing to disordered swallowing in elderly women. In each case there was a pulmonary inflammatory reaction followed within a few hours by death. Experimental and clinical reports of barium inhalation are reviewed and the hazard of aspiration of high density barium preparations in elderly and debilitated patients with dysphagia is emphasised.

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MATERIAL AND METHODS

MATERIAL & METHOD

The present study was carried out in the Department of Radiology, M.L.B. Medical College, and Hospital, Jhansi. The patients attending the Medicine and Surgery Out Patient Department of M.L.B. Medical College, Jhansi with the complaint of epigastric pain, with or without associated features, were selected for this study.

In all the cases conventional barium meal studies were carried out under image intensifier control.

M A T E R I A L :

Equipment :

The generator, overhead X-ray tube, Image intensifier and fluoroscopic viewing system (T.V.chain).

- X-ray films, cassettes and screen.
- Developer and fixer solutions.
- Illuminating box.

Contrast media :

A high density, low viscosity barium sulfate suspension, commercially available as Crem-O-Bar 100% w/v was used.

Radiographic factors :

Kilovoltage was kept in the range of 60-80 KVP and, exposure in the range of 50-60 mAS.

M E T H O D :

Patient was instructed to take nothing orally for 8 hours prior to the examination and also to abstain from smoking.

The patient was asked to report the department of Radiology in the morning, empty stomach.

After noting down the name, age, sex and address of the patient detailed history was taken. History of food habits and drug intake was also taken.

The site, severity, frequency, radiation of pain, relationship of pain with meals was noted down. Other associated features like nausea, vomiting, loss of appetite, loss of weight, haematemesis, any lump if present were also sought.

Then, patient was examined by image intensifier to look for any gastric residue. If any residue was present, the procedure was postponed.

All the studies were undertaken under fluoroscopic control of image intensifier and films were taken as and when necessary.

A total of 250-350 ml of barium suspension in 50% weight/volume concentration was given to the patient. The examination was done in supine (A.P.), right anterior oblique, right lateral, left posterior oblique, and prone (P.A.) positions in general.

For the study of mucosal pattern of stomach, patient was given 50 ml of barium suspension, while lying on X-ray table and viewed on the T.V. screen immediately, in A.P. view. The patient was then asked to drink whole of the rest of barium suspension and full stomach was visualised.

Then patient was asked to roll from side to side on the table for 5-6 times for adequate coating of barium on the stomach walls.

After 10-15 minutes of ingestion of barium patient was again examined in right anterior oblique position and peristaltic movement, gastric emptying and pyloric antrum were seen.

Timings of further examination depended upon movement of contrast media. Duodenum was examined in prone, R.A.O., Supine and LAO position.

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OBSERVATIONS

OBSERVATION

The present study was carried out in the Department of Radiology, M.L.B. Medical College, Jhansi. A total of 50 patients, who presented with the complaint of epigastric pain, were subjected to the conventional barium meal examination. The study was carried out with image intensifier.

The following observations are based on the interpretation and analysis of the results obtained.

TABLE - 1 : DISTRIBUTION OF CASES

Age group (Yrs)	No. of cases	Percentage
20 - 29	06	12.0
30 - 39	20	40.0
40 - 49	18	36.0
50 - 59	04	08.0
60 - 69	02	04.0
TOTAL	50	100.0

The age of the patients ranged from 20 to 65 years. Maximum cases (20) were seen in the age group of 30 - 39 years (40%). Minimum cases (2) belonged to the age group of 60 - 69 years (4%).

TABLE - II: SEX DISTRIBUTION OF CASES

Sex	No. of cases	Percentage
Male	40	80.0
Female	10	20.0
TOTAL	50	100.0

The sex distribution of cases was in favour of males, the male : female ratio being 4 : 1.

Clinical features :

All the patients presented with epigastric pain.
Other associated features are shown in table - III.

TABLE - III : SHOWING THE CLINICAL FEATURES

Sl. No.	Clinical features	No. of cases	Percentage
1.	Vomiting	18	36.0
2.	Anorexia	08	16.0
3.	Weight loss	06	12.0
4.	Lump in abdomen	04	08.0
5.	Haemetemesis	03	06.0
6.	Recurrent jaundice	02	04.0

It is obvious from table - III that after pain vomiting was the commonest complaint, seen in 18 cases (36%). It was followed by anorexia seen in 8 cases (16%). Other common associated features were weight loss (12%), lump in abdomen (8%) and haemetemesis (6%).

Radiological interpretation :

The conventional barium meal series of all the patients were carefully studied. Their interpretation is summarised in table - IV.

TABLE - IV : SHOWING RADIOLOGICAL INTERPRETATION

Sl. No.	Radiological diagnosis	No. of patients	Percentage
1.	Duodenal ulcer	14	28.0
2.	Malignancy stomach	05	10.0
3.	Gastric ulcer	01	02.0
4.	Pseudo-pancreatic cyst	02	04.0
5.	Hiatus Hernia	02	04.0
6.	Sub Ac Pyloric obstruction	01	02.0
7.	Multiple gastric erosions	01.	02.0
8.	Normal	24	48.0
TOTAL		50	100.0

The radiological diagnosis was established in 26 cases (52%), whereas 24 cases (48%) were found normal on barium meal examination. It is clear from the above table that peptic ulcer cases (15 cases i.e. 30%)

constituted majority of the cases included in this study. Out of these 14 cases (28%) were of duodenal ulcer and 1 case was of gastric ulcer (2%).

Table - V shows the age distribution of peptic ulcer cases.

TABLE - V : SHOWING THE AGE DISTRIBUTION OF PEPTIC ULCER CASES

Age group (Yrs)	No. of patients	Percentage
20 - 29	04	26.6
30 - 39	07	46.6
40 - 49	03	20.0
50 - 59	02	13.3

Maximum number of patients with peptic ulcer were from the age group of 30 - 39 years (7 cases i.e. 46.6%).

Duodenal ulcer were found more commonly in males.

Table VI shows the sex distribution of duodenal ulcer.

TABLE - VI : SHOWING THE SEX DISTRIBUTION OF PEPTIC
ULCER

Sex	No. of cases
Male	14
Female	01

Male : female ratio in peptic ulcer patients
was found to be 14 : 1.

The radiological findings of duodenal ulcers are comprised in table - VII.

TABLE - VII : SHOWING THE RADIOLOGICAL FINDINGS OF DUODENAL ULCER CASES

Sl. No.	Radiological finding	No. of cases
1.	Deformed duodenal cap	12
2.	Ulcer crater at supero-posterior surface of duodenal cap	08
3.	Ulcer crater at inferior surface of duodenal cap	03
4.	Undermining of mucosa	02
5.	Fluid level	03

It is clear from the above table that deformed duodenal cap was the most common radiological sign seen. In 8 cases ulcer crater was seen on supero-posterior surface of duodenal cap while in 3 cases crater was seen on inferior surface. Undermining of mucosa was present in 02 cases while 3 cases showed fluid level.

In one case of duodenal ulcer, ulcer crater were seen in the pyloric canal (Fig - 2.)

Gastric ulcer was seen in only one case. In this case, ulcer crater of more than one c.m. size was present on lesser curvature (Fig - 1).

Multiple gastric erosions were seen in one case. Coarse rugal pattern was evident on barium meal examination (Fig -).

TABLE - VIII : SHOWING THE RATIO OF DUODENAL AND GASTRIC ULCERS

Type of ulcer	No. of cases
Duodenal ulcer	14
Gastric ulcer	01
TOTAL	15

It is evident from the above table that the ratio of duodenal and gastric ulcer was 14 : 1.

Malignancy of stomach constituted the second largest group of patients (5 patients i.e. 10%). The site of malignancy of stomach as demonstrated by conventional barium meal examination are tabulated below.

TABLE - IX : SHOWING SITE OF MALIGNANCY OF STOMACH

Sl. No.	Site of malignancy	No. of cases	Percentage
1.	Fundus of the stomach	01	20.0
2.	Body of the stomach	01	20.0
3.	Pylorus	03	60.0
TOTAL		05	100.0

It is evident from the above table that pylorus of the stomach (3 cases i.e. 60%) was involved in majority of the cases of gastric carcinoma.

The gastric carcinoma in the body of the stomach was seen to involve the greater curvature in all the cases.

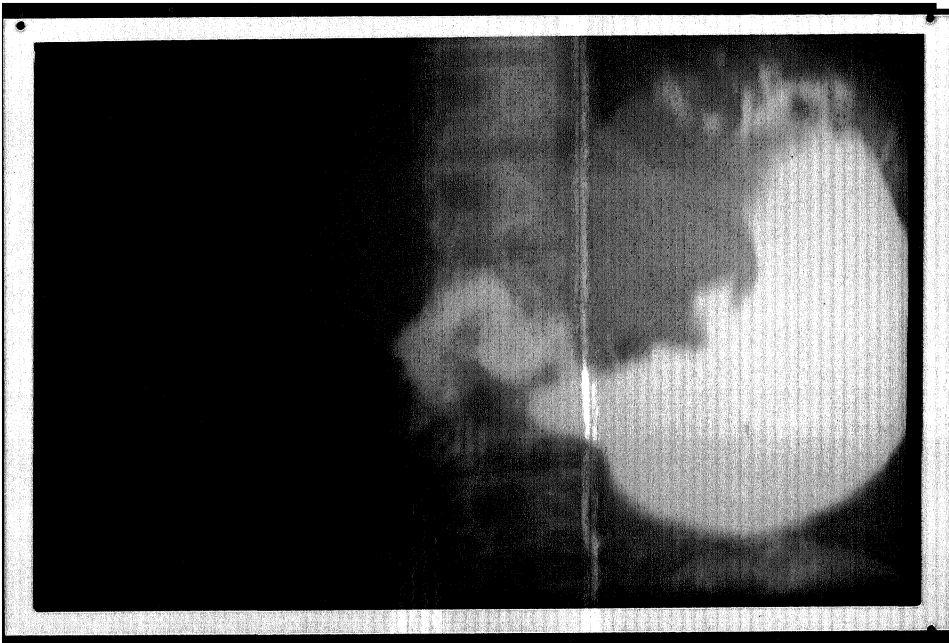
Pseudopancreatic cyst was seen in 2 cases. Barium meal examination showed significant anterior displacement of the stomach alongwith smooth indentation on posterior gastric wall (Fig -12).

In 1 case, sub-acute pyloric stenosis was present which seemed to be due to coexisting duodenal ulcers.

In 24 cases (48%) barium meal examination was normal.

Thus in this series peptic ulcer was the most commonly seen pathology, followed by malignancy of stomach, while 48% of cases were found to be normal on barium meal examination.

&&



**Fig-1: Large Benign Gastric
Ulcer: Stomach of
normal size. Large
ulcer crater seen at
lesser curvature with
deformed duodenal cap.**

**Fig-2: Chronic Multiple ulcers
at Pyloric Canal : 3-4
ulcer craters with mucosal
oedema seen in pyloric
canal. Triangular duodena
cap.**



**Fig-3: Chronic Duodenal Ulcer:
Gross deformity of duo-
denal cap. Large ulcer
Crater seen at superior
surface of duodenum (A.P.
Projection).**

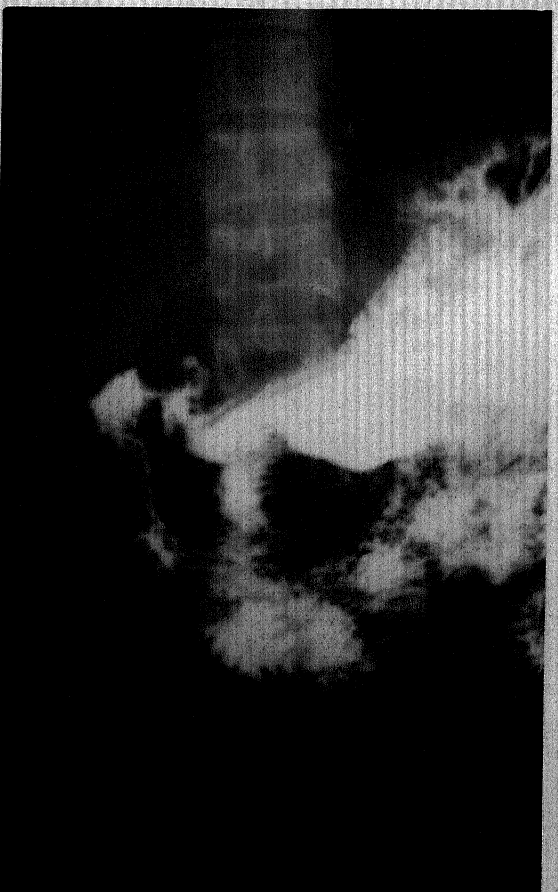


Fig-4: Duodenal Ulcer: Mucosal oedema seen in duodenal cap with 3 small ulcers at poster^o-superior surface (P.A. Oblique)

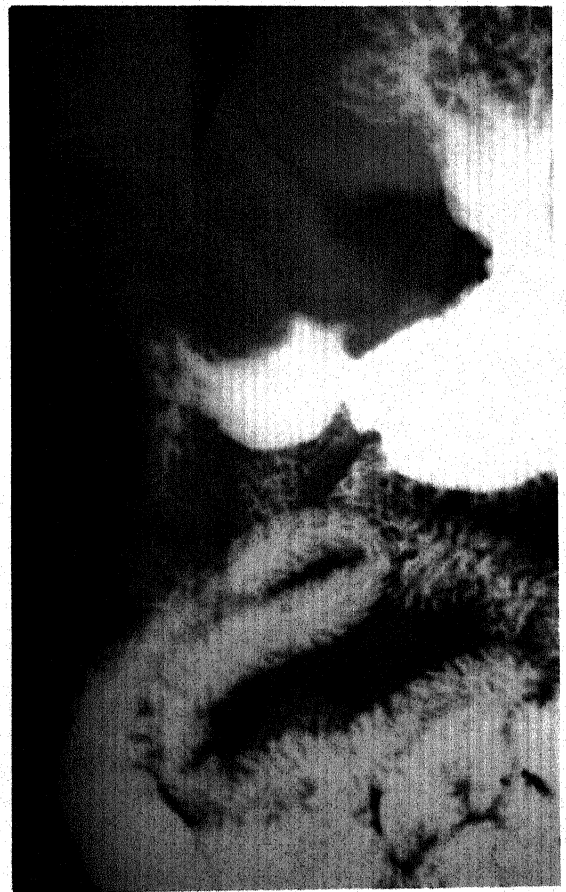


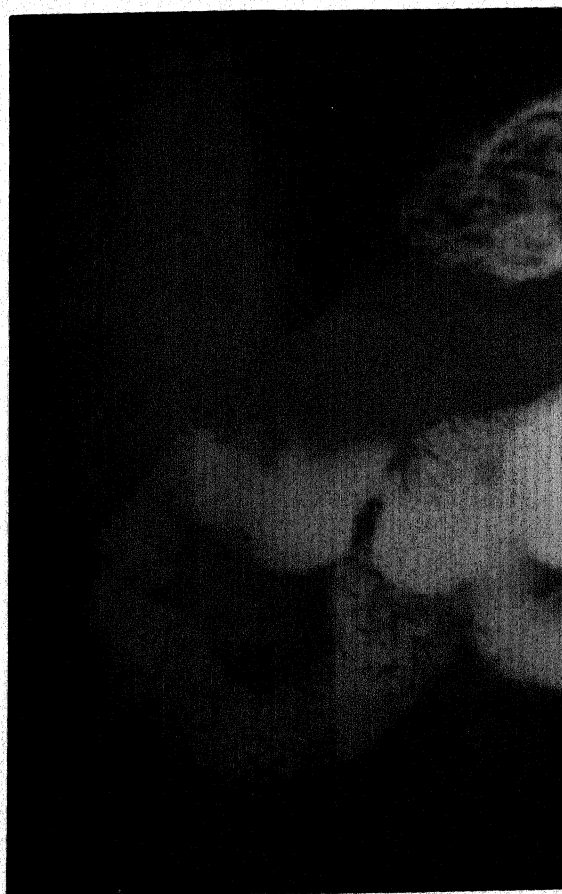
Fig-5: Duodenal Ulcer: Deformed duodenal cap with multiple small ulcer craters at superior surface (P.A. Oblique).



Fig-8: Duodenal Ulcer : Large ulcer crater seen on postero-superior surface of duodenum with deformed duodenal cap (P.A.Oblique)



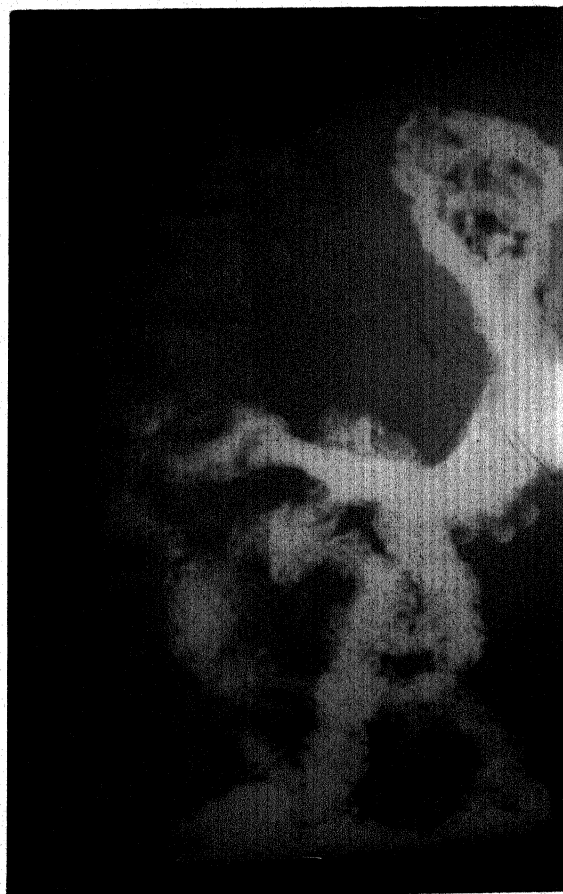
Fig-9: Duodenal Ulcer : Large ulcer craters seen on superior surface of duodenal cap (A.P. Projection)



**Fig-11& 12 : Pseudopancreatic
cyst. Soft tissue mass
indenting the lesser
curvature. Stomach is
displaced towards left
side (A.P. view).**

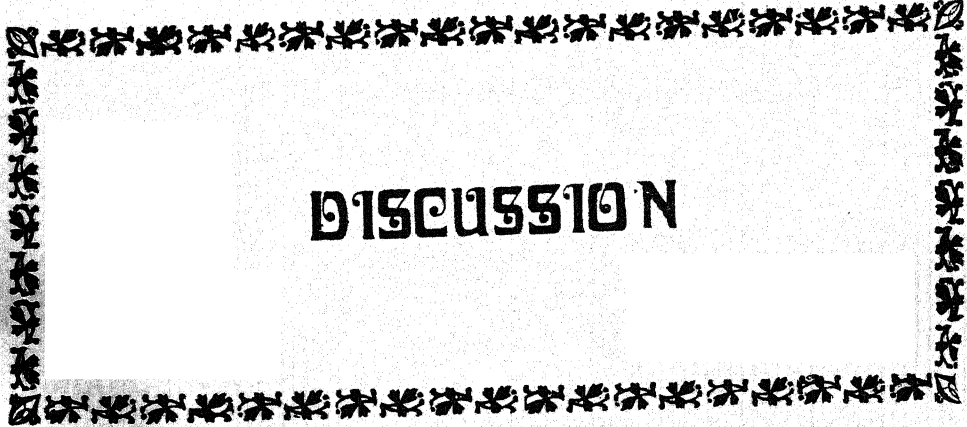


**Fig-13: Malignancy of stomach :
Multiple filling defects
seen at greater curvature
giving false impression
of diverticulae formation
(P.A. Oblique)**



**Fig-14: Carcinoma stomach: Multiple
irregular filling defects
seen at greater curvature
(A.P. Projection)**





DISCUSSION

DISCUSSION

The present study was conducted with a view to find out the incidence of peptic ulcer in patients complaining of epigastric pain. In this series of 50 patients who were subjected to conventional barium meal examination, the findings were evaluated and compared with other works.

The principle of conventional barium meal is to delineate the lumen of stomach and mucosal folds with the help of barium sulphate. Fluoroscopic examination is done so that optimum delineation of various parts of stomach and duodenum can be done in different positions before the radiography, as well as to confirm the movement of barium column, filling defects and spasm of bowel wall.

Barium sulphate is the contrast media of choice for G.I.T. No other substance competes with barium as a radiographic contrast media for coating the gastrointestinal mucosa (James WB 1978). Thickness of the radiopaque material retained at bowel surface is related to the concentration of suspension.

High density suspensions give better coating of the bowel mucosa (Simmonds and James 1976).

Kench (1976), referring particularly to barium sulfate suspension for upper gastrointestinal work, showed that high quality examinations are best obtained with crushed natural barium sulfate containing rough particles with jagged edges having a range of diameter from 0.5 micron to 30 micron. As far as concentration is concerned, a compromise has to be achieved between high density and low concentration both of them are desirable.

In our study, we have used "Crem-C-bar" a commercial preparation of medium density barium sulfate containing micronized barium sulfate in a concentration of 100% w/v.

In the various previous studies by Kawai et al (1970), Louis Kreel et al (1973), Igar Laufer et al (1970), JH Hunt and Anderson (1976), Stephen Bloom et al (1977), high density and low viscosity barium sulfate with concentration ranging from 70% to 250% have been used with comparable results.

Age and Sex :

In the present study maximum number of peptic ulcer was seen in the age group of 30 - 39 years (43.7%). Dogra JR (1940); Malhotra SL (1964); Tovey FI (1972) also reported the peak age incidence of peptic ulcer as 30-40 years. In western countries peptic ulcer is more common in the age group of 40-50 years (Coggon 1981).

Males are more affected by peptic ulcer than females. Male : female ratio was found to be 14 : 1.

The male : female ratio was 18 : 1 in Dogra's (1940) series, 15 : 1 in Hadley's (1959) series, 10 : 1 in Gopala Rao's (1959) series and 16 : 1 in Raghuachari's (1959) series. Very high male/female ratio of 35 : 1 was reported by Malhotra (1967), the reasons for this high sex ratio was not clearly explained.

In United Kingdom, the corresponding ratio has steadily fallen and now it is approximately 1.9 : 1 (Tovey 1979).

Duodenal to gastric ulcer ratio :

In our study incidence of duodenal to gastric ulcer was found to be 14 : 1.

Dogra (1940) reported duodenal and gastric ulcer ratio as 30 : 1, in Hadley's series (1959), the ratio was 13 : 1. Malhotra SL (1967) in his work reported duodenal and gastric ulcer ratio to be 12 : 1.

In the present study the incidence of peptic ulcer in epigastric pain cases was found to be 30%. Majority of patients had duodenal ulcer (28%), while 2% had gastric ulcer.

Our findings are in accordance with the study of Holliman KM, Bonnevie O, Gudmand HE and Wolff HR (1975). In their study of 197 patients with upper abdominal pain. It was found that 38% of patients had peptic ulcer and the ratio of gastric ulcer to duodenal ulcer was 1 : 1.9. This ratio is identical to the ratio found in western population.

Horrocks J and De Dombal (1978), studied the clinical presentation of 360 patients with dyspepsia. They found that out of 360 patients, presenting with dyspepsia 130 patients (35.1%) had peptic ulcer.

The difference in incidence of peptic ulcer reported by these workers and our study may be due to difference in race, diet and alcohol consumption.

Out of 14 cases diagnosed as duodenal ulcer, ulcer crater was demonstrated in 11 cases (78.5%) out of which in 57% of cases ulcer crater was seen on superior surface of duodenal cap while in 21.3% of cases crater was on inferior surface.

In the study of Stein et al (1964), it was found that majority of duodenal ulcers (47%) were on the superior surface of duodenal cap. 16% of ulcer crater were reported to be an inferior surface.

In 12 cases of duodenal ulcer duodenal cap was found deformed (85.7%). Templeton FE (1944) demonstrated deformed duodenal cap in 81.6% of duodenal ulcer patients Stain et al (1964) found deformed duodenal cap in 86.4% of patients in whom ulcer crater was demonstrated.

Incination of mucosa was seen in 2 cases while fluid level was present in 3 cases of duodenal ulcer.

In this series only one case of gastric ulcer was seen. Ulcer crater was present in the body of stomach, on lesser curvature. Ulcer crater was more than one c.m. in size and surrounded by oedematous mucosa (Fig- 1).

Out of 50 patients, malignancy of stomach was seen in 5 cases. Growth involved pylorus in 3 cases, while fundus and body of stomach was involved in one case each.

In a case of carcinoma pyloric region irregularity and involvement of greater curvature was clearly demonstrated.

Thus, it can be inferred that findings of our study are comparable to the work of many Indian & western authors.

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SUMMARY & CONCLUSION

SUMMARY AND CONCLUSION

Epigastric pain is one of the commonest complaints met in clinical practice and it's causes are so diverse as to make diagnosis difficult.

Peptic ulcer is one of the common causes of epigastric pain. The present study has been conducted with the aim of finding out the incidence of peptic ulcer in epigastric pain cases.

In all the cases included in this study conventional barium meal examination was carried out under image intensifier control. Examination was done in supine (AP), right anterior oblique, right lateral, left posterior oblique and prone (PA) positions in general. Films were taken as and when required.

50 patients with epigastric pain were selected for this study. These patients were subjected to conventional barium meal examination under image intensifier control.

Patients ranged from 20 years to 65 years of age with a maximum number (40%) of them in their third decade.

Of the total patients males comprised 80% and females 20%. All the patients presented with a common complaint of epigastric pain. Vomiting, weight loss and lump in abdomen were other common symptoms.

Clinically, peptic ulcer was the commonest provisional diagnosis, while carcinoma stomach came next.

On barium meal examination, pathology was detected in 52% of cases and 48% cases were found to be normal.

Barium meal study showed peptic ulcer in 30% of cases, malignancy of stomach in 10% of cases, pseudo pancreatic cyst and hiatus hernia in 4% each.

Subacute pyloric obstruction and multiple gastric erosions were seen in 4% of cases.

The study showed male predonderance of peptic ulcer. Male : female ratio was found to be 14 :1. Maximum occurrence of peptic ulcer was seen in the age group of 30 - 39 years.

Duodenal ulcers were found to be more common than gastric ulcer with a ratio of 14 : 1.

In this study incidence of peptic ulcer in epigastric pain cases was found to be 30%.

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BIBLIOGRAPHY

BIBLIOGRAPHY

1. Amplatz K. A new and simple approach in air contrast studies of the stomach and duodenum. *Radiology*, 70 : 392-394, 1958.
2. Anderson W, Harthhill JE, James WB and Montgomery D. Barium sulphate preparations for use in double contrast examination of the upper gastrointestinal tract. *Brit J Radiol*, 53 : 1150-1159, 1980.
3. Arfeen S, Salter RM, Girdwood TG. Negative double contrast barium meal - qualified reassurance. *Clinical Radiology*, 38 : 49, 1987.
4. Bagnall RD, Galloway RW and Anis JAD. Double contrast preparations. An in vitro study of some anti-foaming agents. *B J R*, 50 : 546-550, 1977.
5. Bloom SN, Paul RE, Matsue H, Poplack WE and Goldsmith MR. Improved radiographic detection of multiple gastric ulcers. *Amer J Roentgenol*, 128 : 949-952, 1977.
6. Bonnevie O. The incidence of duodenal ulcer in Copenhagen County. *Scand J Gastroent*, 10 : 385-393, 1975.
7. Brown RC, Langman MJS, Lambert FM. Hospital admissions for peptic ulcer during 1958-1972. *British Medical Journal*, 1 : 35-37, 1976.

8. Buonocore E and Meaney TF. Double contrast radiographic examinations of upper gastrointestinal tract using barium spray technique. *A J Gastroenterology*, 46 : 13 - 20, 1966.
9. Chuttani CS, Wig KL, Chablani TD. Epidemiology of peptic ulcer 1 Prevalence of peptic ulcer in an urban community in Delhi. *Indian Journal of Medical Research*, 55 : 1121-1128, 1967.
10. Coggen D. 20 years of hospital admissions for peptic ulcers in England and Wales. *Lancet*, 1 : 1302-4, 1981.
11. Cohen MD. The value of cimetidine in routine barium meals. *Brit J Radiology*, 52 : 408-9, 1979.
12. Cooley RN. The diagnostic accuracy of upper gastrointestinal tract. *Radiological studies. Amer J Med Sci*, 24 : 268, 1961.
13. Cotton PB. Fibre-optic endoscopy and the barium meal results and implications. *B Med J*, 2 : 161, 1973.
14. Cumerberland DC. Optimum viscosity of barium suspension for use in the double contrast barium meal. *Gastrointestinal Radiology*, 2 : 169-174, 1977.

15. C-Gray, Sivalinganathan Simpkins KC et al. Aspiration of high density barium contrast medium causing acute pulmonary inflammation. Report of two fatal cases in elderly women with disordered swallowing. Clinical Radiology, 40(4) : 397-400, 1989.
16. Davenport PM, Morgan AG, Darmborough A and D, Dombal FT. Can preliminary screening of dyspeptic patients allow more effective use of investigation-al techniques ? Brit Med J, 290 : 217-219, 1985.
17. Dooley CP, Larson AW, Stace NH, Rawnner IG, Valenzuela JG, Eliasoph J, Goletti PM, Holls JM and Weiner JM. Double contrast barium meal and upper gastrointestinal endoscopy. A comparative study. Ann Int Med, 101 : 538-545, 1984.
18. Edwards FC. Clinical manifestations in patients with chronic atrophic gastritis, gastric ulcer and duodenal ulcer. Quarterly Journal of Medicine, 146 : 337-345, 1968.
19. Blaschhoff JD, Grossman MI. Trends in hospital admission and death rates for peptic ulcer in the United States from 1970-1978. Gastroenterology, 78 : 280-5, 1980.

20. Fresney PC. Double contrast gastrography at the fundus and cardia ; normal landmarks and their pathological changes. Amer J Roentgen, 133 : 481-87, 1979.
21. Gault ED. Note on peptic ulcer. ICMR Reports, 39 : 33-47, 1959.
22. Gelfand DW. High density, low viscosity barium for fine mucosal detail on double contrast upper gastrointestinal examinations. Am J Radiol, 130 : 831-833, 1978.
23. Gelfand DW. The Japanese stylo double contrast examination of the stomach. Gastrointest Radiol, 1 : 8-17, 1976.
24. Gelfand DW, David J Ott and Roccotrittico. Causes of error in gastrointestinal radiology. Gastrointest Radiol, 5 : 91-97, 1980.
25. Gelfand DW and David J Ott. Area gastricae traversing the esophageal hiatus - A sign of hiatus hernia. Gastrointestinal Radiology, 4 : 127-129, 1979.
26. Gelfand DW and Hachiya J. The double contrast examination of stomach using gas producing granules and tablets. Radiology, 93 : 1381-1382, 1969.

27. Gelfand DW. The double contrast upper gastrointestinal examination in the Japanese style. An experience with 2000 examination. Am J Gastroenterol, 63 : 216-220, 1975.
28. Gelfand DW. Single versus Double contrast gastrointestinal studies. Critical analysis of report statistics. American J Radiology, 137 : 523-528, 1981.
29. Gobel VK, Kressel HY and Laufer I. Double contrast artefacts. Gastroint Radiol, 3 : 139-46, 1978.
30. Gobel VK and Laufer I. Double contrast examination of the post operative stomach. Radiol, 129 : 601-607, 1978.
31. Goldsmith MR, Paul RE, Poplack WE, Moore JP, Matsue H and Bloom S. Evaluation of routine double contrast views of the anterior wall of the stomach. Am J Roentgen, 126 : 1159-63, 1976.
32. Gopichandran TD, Ring NJ and Beckley DE. Metoclopramide in double contrast barium meals. Clinical Radiol, 31 : 484-88, 1980.
33. Gold RP and Seaman WB. The primary double contrast examination of post-operative stomach. Radiology, 124 : 297-305, 1977.

34. Graser GM. The double contrast barium meal in patients with acute upper gastrointestinal bleeding. Clin Radiol, 29 : 625-634, 1978.
35. Gupta Ajay. Double contrast barium meal. Radiologist's answer to endoscopist's challenge. Ind J Radiology, 33 : 32-35, 1979.
36. Herlinger H, Robert, Grossman, Igor Laufer, Herbert Y, Kressel and Richards H, Ochs. The gastric cardia in double contrast study : Its dynamic image. AJR, 135 : 21 - 29, 1980.
37. Herlinger H and Rubesin S. Factors influencing areae gastricae demonstration. Digest Dis Sci, 29 : 663, 1984.
38. Horrocks JC, De Dombal FT. Clinical presentation of patients with dyspepsia. Gut, 19 : 19, 1978.
39. Hunt JH and Anderson IF. Double contrast upper gastrointestinal studies. Clin Radiol, 27 : 87-97, 1976.
40. Hunt RH, Milton GJ. The epidemiology and pathogenesis of gastric ulcer. Front Gastrointest Res, 6 : 57-70, 1980.

41. Ichikawa H. Double contrast radiography of the stomach by Ichikawa. International Medical Foundation of Japan, 1974.
42. James WB, McCreath G, Sutherland GR and McDonald M. Double contrast barium meal examination. A comparison of techniques for introducing gas. Clin. Radiol, 27 : 99-101, 1976.
43. James WB. Double contrast radiology in gastrointestinal tract. Clinics in Gastroenterology, 7 (2) : 397-429, 1978.
44. Jenner D. Perforated peptic ulcer. Changes in age incidence and sex distribution in last 150 years. Lancet, 1 : 395-8; 444-7, 1940.
45. Jenner D. In Buckus gastroenterology III edition, Volume 2.
46. J Odo Opden Orth JO. Use of barium in evaluation of disorder of the upper gastrointestinal tract current status. Radiology, 173 : 601, 1989.
47. Kohn K and Greenfield S. Endoscopy in the evaluation of dyspepsia. Ann Intern Med, 102 : 266-69, 1985.
48. Kawai K, Takada H, Takekoshi T, Misaki F, Murakami K, Masada, M, Nishizawa M, Hayakawa, H and Shikabe H. Double contrast radiography on routine examination

49. Keller, RJ, Bernard SW and Manshoe TK. Roentgen features of healed and healing gastric ulcers. Radiol, 97 : 353-59, 1972.
50. Koga M, Nakata, H, Hideyasu K, Masatak I, Makoto T and Nobe T. Minute mucosal patterns in gastric carcinoma. Radiol, 120 : 199-201, 1976.
51. Koga M and Nakata H et al. Roentgen features of the superficial depressed type of early gastric carcinoma. Radiology, 115 : 289-292, 1975.
52. Kreel L. Recent advances in gastroduodenal radiology. The surface patterns of the stomach. Proc R Soc Med, 68 : 111, 1975.
53. Kreel L, Herlinger H and Glanville J. Techniques of the double contrast barium meal with examples of correlation with endoscopy. Clinical Radiology, 24 : 307-14, 1973.
54. Longman MJS. The epidemiology of chronic digestive disease. London : Edward Arnold, 9 : 39, 1979.
55. Longman MJS. Changing patterns in the epidemiology of peptic ulcer. Clin Gastroenterol, 2 : 219-26, 1973.
56. Laufer I. Double contrast gastrointestinal radiology W.B. Saunders Co. 1979.

57. Laufer I. A simple method for routine double contrast study of the upper gastrointestinal tract. *Radiology*, 117 : 513-18, 1975.
58. Laufer I. Assessment of accuracy of double contrast gastroduodenal radiology. *Gastroenterology*, 71 : 874-78, 1976.
59. Laufer I, Edward M and John Hailton. The diagnostic accuracy of barium studies of stomach and duodenum correlation with endoscopy. *Radiol*, 115 : 569-73, 1975.
60. Laufer I, Hamilton Muller JE. Demonstration of superficial gastric erosion by double contrast radiography. *Gastroenterology*, 68 : 387-391, 1975.
61. Lavelle MI, Vinables CW, Douglas AP, Thomson MH, Owen JP and Hacking PM. A comparative study of double contrast and single contrast barium meal with endoscopic arbitration in the diagnosis of peptic ulcer. *Clin Radiol*, 28 : 625-27, 1977.
62. Lintott DJ, Simpkins KC, Dmbel FT and Noakes MJ. Assessment of double contrast barium meal. Method and application. *Clin Radiol*, 29 : 313-21, 1978.
63. Longstreth GF, Newcomer AD. Abdominal pain caused by diabetic reticulopathy. *Ann Intern Med*, 86 : 166,

64. Mackintosh CE and Kreel L. Anatomy and radiology of
areae gastricae. GUT, 18 : 855-64, 1977.
65. Maglinte D, Olan PA and Millar RE. Angled radiography
in upper gastrointestinal examination. Am J of
Radiol, 137 : 1082-84, 1981.
66. Malhotra SL. Peptic ulcer in India and its aetiology.
GUT, 5 : 412-16, 1964.
67. Malhotra SL. Peptic ulcer in Assam. GUT, 5 : 355-8,
1964.
68. Malhotra SL. Epidemiological study of peptic ulcer
in South of India. GUT, 8 : 180-8, 1967.
69. Mare S, Evine L, Stephen E, Rubesin, Hans Herlinger and
Igor Laufer. Double contrast upper gastrointestinal
examination. Technique and Interpretation.
Radiology, 168 : 593-602, 1988.
70. Margulis AR and Ominsky SE. The biphasic examination of
the upper gastrointestinal tract. In radiology of
the stomach Eds. Marshak RH, Ldner AE and Maklansky
D. Philadelphia : WB Saunders Co.
71. Martel W et al. Tubeless hypotonic duodenography.
Technique value and limitations. Am J Roentgenol,
107 : 119-123, 1969.

72. Martin RG, Robert EP, William EP, Jeffery PM, Iiro TM and Stephen B. Evaluation of routine double contrast views of the anterior wall of stomach. A J R, 126 : 1159-63, 1976.
73. Martin TR Vennes JA, Slivis SE and Ansell HJ. A comparison of upper gastrointestinal endoscopy and radiography. J Clin Gastroenterol, 2 : 21-25, 1980.
74. Miller RE. The areae gastricae. Epilogue Amer J Radiol, 132 : 1023-24, 1979.
75. Mohammed SH and Hededus U. Double contrast examination of stomach. Act Radiol, 18 : 249, 1977.
76. Mollman KM, Bonnevie O, Gudmand HE, Wolff HR. A diagnostic study of patients with upper abdominal pain. Scand J Gastroent, 10 : 805-809, 1975.
77. Montagne JP et al. Double blind study of single and double contrast upper gastrointestinal examinations using endoscopy as a control. Am J Roentgenol, 130: 1041-1045, 1978.
78. Moule B, Cochrane KM, Sekhi GS, Russell RL and Blumgart LH. A comparative study of diagnostic value of upper gastrointestinal endoscopy and Radiology, GUT, 16 : 411, 1975.

79. Obta WG. A double contrast technique for examination of the stomach using barium sulphate with simethicone. A J R, 115 : 275-80, 1972.
80. O' Reilly GVA and Bryan G. The double contrast barium meal - a simplification. B J R, 47 : 82-83, 1974.
81. Pochaezewsky R. Bubbly barium: A carbonated cocktail for double contrast examination of the stomach. Radiol, 107 : 461-62, 1973.
82. Poplack W, Roberts EP, Martin G et al. Demonstration of erosive gastritis by the double contrast technique. Radiol, 117 : 519-21, 1975.
83. Quizlbash A, Harnorinee GI and Castelli M. Early gastric carcinoma. Arch Pathol, 101 : 610, 1977.
84. Raghvan P. Cited from peptic ulcer in India and Bangladesh in Gut, 20 : 329-347, 1979.
85. Richard P, Gold and William B. Seaman. The primary double contrast examination of post-operative stomach. Radiol, 124, 297-305, 1977.
86. Roberts GM, Roberts EE, Davies RL and Evans KT. Observations on the behaviour of barium sulphate suspension in gastric secretion. Brit J Radiol, 50 : 468-72, 1977.

87. Roberts GM, Roberts EE, Davis RL and Evans KT. In vivo and in vitro assessment of barium sulphate suspension. B J R, 50 : 541-45, 1977.
88. Rubisin SE and Merlinger H. Effect of barium suspension viscosity on the delineation of ariae gastricae. A J R, 11 : 93, 1986.
89. Scott-Harden WG. Evaluation of double contrast gastro-duodenal radiology. B J R, 46 : 153, 1973.
90. Scott-Harden WG. Upper digestive tract radiology today. B J R, 49 : 658-59, 1976.
91. Shimi SM. Peptic ulcer perforation - A complication of double contrast barium meal examination. Scot Med Journal, 34 : 500, 1989.
92. Shirakabe H, Ichikawa H and Kumakura K. Atlas of X-ray diagnosis of early gastric cancer. Philadelphia J B Lippincott, 1966.
93. Shirakabe H. Double contrast studies of the stomach. Bunkodo Co Ltd, Tokyo, Japan, 1971.
94. Shore JH, Stone DL. Duodenal ulcer among Northwest coastal Indian women. Am J Psych, 130 : 774-7, 1973.
95. Sievers ML, Marquis JR. Duodenal ulcer among South western American Indians. Gastroenterology, 42 :

96. Simpkins KC. A textbook of radiological diagnosis
5th edition vol no. IV, p 157-73, 1988.
97. Simpkins KC and Sutton, David. A textbook of Radiology
and Imaging 4th edition, 780-862.
98. Solanke TF, Kumakura K, Masakazu M and Someya N. Double
contrast method for evaluation of gastric lesions.
GUT, 10 : 436-42, 1969.
99. Thomson G, Somers S and Stevenson GW. Benign gastric
ulcer : A reliable radiographic diagnosis ? Amer
J Roentgen, 331-333, 1983.
100. Tovey FI, Tunstall M. Duodenal ulcer in black population
in Africa South of the Sahara. GUT, 16 : 564-76,
1975.
101. Tovey F. Peptic ulcer in India and Bangladesh. GUT,
20 : 329-47, 1979.
102. Wolfe MS. Current concepts in parasitology : giardiasis
N Engl J Med, 298 : 319, 1978.
103. Young JW, Ginthner TP, Gobein RP and Paris B. The
diagnostic and cost effectiveness of overhead
projections in double contrast examination of the
stomach and duodenum. Gastroint Radiol, 123-27,
1983.

104. Young JW, Ginthner TP and Keramati B. The competitive barium meal. Clin Radiol, 36 : 43-46, 1983.
105. Ziervogel MA, McGreath GT, Weir R and Fitzgerald Finch CP. A comparison of two barium sulphate preparations -Baritop 100 and Micropaque. Clin Radiol, 24 : 304-6, 1973.
